FAA GENERAL AVIATION NEWS

JULY 1976

A FLIGHT STANDARDS SAFETY PUBLICATION FOR AIRMEN

Flying goes back to the grass roots . . .

COVER:

Pitts Special prepares for takeoff at Frederick, Md.

FAA GENERAL AVIATION NEWS

DEPARTMENT OF TRANSPORTATION/FEDERAL AVIATION ADMINISTRATION VOL. 15, NO. 3

CONTENTS/July 1976

3 Schoolbuilt Airplanes

7 Vital Actions . . . when seconds count

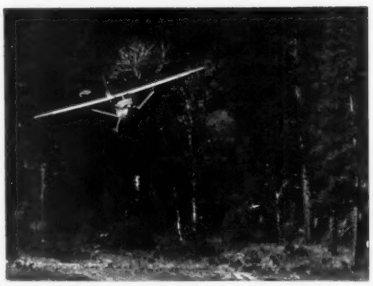
10 The Firefighter

12 The Suggester

13 Briefs

14 News Log: FAA Recommendations for Coping With Wind Shear . . . Five-Second Flight Makes History . . . New Thunderstorm Alert Tested . . . Special Traffic Pattern for EAA . . . GA Airport Noise Guide Issued

15 Forum



No time to wonder page 7

Airman's nightmare page 10

William T. Coleman, Jr., *Secretary of Transportation*
Dr. John L. McLucas, *Administrator, FAA*
R. P. Skully, *Director, Flight Standards Service*
Bernard A. Geier, *Chief, General Aviation Division*

David Gelfan, *Editor*
Gernot Rasmussen, *Art Director* Ruth Taksel Benedict, *Assistant Editor*,
Louise Oertly, *Editorial Assistant*

FAA GENERAL AVIATION NEWS is published by Flight Standards Service, Federal Aviation Administration, Department of Transportation, Washington, D.C. 20591, in the interest of flight safety. The magazine is designed to promote safety in the air by calling the attention of general aviation airmen to current technical, regulatory and procedural matters affecting the safe operation of aircraft. The use of funds for printing FAA GENERAL AVIATION NEWS was approved by the Director of the Office of Management and Budget on July 30, 1974. All printed materials contained herein are advisory or informational in nature and should not be construed as having regulatory effect. The FAA does not officially endorse any goods, services, materials or products of manufacturers that may be mentioned.

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FAA GENERAL AVIATION NEWS is sold on subscription at $6.20 per year (individual copies, 55 cents) by the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Use the self-mailer order form in the centerfold of this magazine to subscribe. Prices are subject to change without prior notice.

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School Built Airplanes

There are few parts of light aircraft that cannot be fabricated or installed with the tools normally found in a high school shop. The task is within the ability of most high school students.

At the close of the school year, when most youngsters learned from report cards how they fared in class, certain students in some 100 schools across the nation were facing a different kind of moment of truth. These students journeyed to a nearby airport, generally a grass strip, where they waited in suspense to see if the airplane they built, from scratch, in their school classroom, would really fly. If past experiences hold true, most of these airplanes indeed flew very well. And a lot of aviation careers were born as the airplane wheels left the ground.

A typical launch event of this kind took place at the Lake Taylor High School in Norfolk, Va., this year. Winding up a two-year program, 14 juniors and seniors in industrial arts classes saw their project completed in late June when the *Sonarai II* they built was test-flown for the first time by their sponsor, a DC-9 pilot who is "graduating" into homebuilts. *Sonarai II* is a two-place taildragger with a single mid-wing that can be folded back against the fuselage for towing behind a car. The airframe has a metal skin, except for the tail section which is fabric covered. The airplane is powered by an 80 hp Volkswagen engine, projected to give a top speed of about 160 mph and it is aerobatic.

As the school year drew toward a close, activity in the well-equipped Lake Taylor shop stepped up, with two evening sessions held each week. One exciting evening the students finally saw the beloved object of their combined labors soar into the sky. Their satisfaction with the result—plus the anticipated fun of getting a ride in the plane (once the flight testing was completed) meant more than any report card grade could possibly mean.

Building an experimental aircraft in the industrial arts classes of an ordinary high school is an idea that goes back at least a quarter of a century, when Robert Blacker was hired to teach a new course in "Aviation Mechanics" at St. Rita's a Catholic high school for boys in Chicago. An experienced pilot with an interest in aviation that dated back to childhood, Blacker had learned airplane maintenance in military service during World War II, and held an FAA Airframe and Powerplant certificate. He had built several airplanes himself, and was very keen on the subject of learning by doing. He observed that there were quite

Bob Blacker's office at FAA Headquarters, left, is long removed from that first school-built *Baby Ace*, above, but he still finds time for an encouraging word to young people considering flying or maintenance careers.

a few empty seats in his aviation classroom —actually a makeshift "hangar" adjoining the school football field.

The students had been exposed to theories of aerodynamics, but many of them had never seen or touched an airplane. Blacker began exciting their interest by writing his own classroom textbook, which related design and construction practices to actual conditions of flight. He soon had his students learning about "lift, thrust and drag" by building model airplanes and taking apart and putting together cast-off airplane components. Next, Blacker got hold of an old, but workable, airplane engine and put it on a test rack on the football field. During lunch hour he would crank it up (noisily) purportedly for test purposes; it never failed to draw a crowd. (Later he would taxi airplanes around the track for the same purpose).

The more airplane parts he brought into the classroom, the higher the enthusiasm of his students rose. By the time they got around to rebuilding a Piper J-3 the 120 places in his three aviation classes were all filled far in advance of the next school year.

For the rest of his nine year's at St. Rita's, Blacker's classes were extremely popular, and quite a few students chose the school specifically for its aviation courses. Two junior "airframe mechanics" classes had a total of 80 pupils; the top half of these classes were able to move on to the "powerplant mechanics" class of 40 students in the senior year.

Although Bob Blacker described himself as a "tough teacher," the students regarded him highly. At noon when he ate his bag lunch in the "hangar" the boys would drift in to talk airplanes. In one of these impromptu hangar-flying sessions the idea of building an airplane from scratch at school first began to take form. *A preposterous idea? Maybe not.* There were so many obstacles—the most obvious having to do with parental permission and funding—plus countless little details that had to be looked into. One by one each problem was overcome, and the project became a reality.

St. Rita's first "school-built" airplane was a Corben *Baby Ace*, a "parasol"wing airplane with a top speed of 100 mph, and a service ceiling of 10,000 feet. Before each unit of construction was attempted there was a thorough classroom study of construction technique. Blacker never let the students forget the life-and-death safety responsibility assumed by the airplane builder. "If we're going to send someone up in this thing, it has to be built right—all the way through."

Blacker was impressed by the ability of high school students to handle technical work, and they in turn were surprised to find that although they were working hard, it hardly seemed like work! An arithmetic problem that seemed overwhelming and use-

In 1961 Blacker and his students at St. Rita's High School in Chicago were putting the finishing touches on the prototype *EAA Biplane* for inspection and its first test flight.

less in math class provided a challenge that could not be shrugged off in the airplane hangar. Writing a descriptive report on a woodworking technique or a welding method seemed a far cry from an English composition on Victorian poetry. This, the class decided, was a project that made sense.

It also made *news*, on that momentous Spring day when the first classroom-built aircraft lifted off the runway with teacher/construction-chief/pilot Blacker in the cockpit. Although none of St. Rita's students were able to fly in the single place "Ace", they all experienced an exhilerating sense of fulfillment. It was not surprising that many of the students went on, after graduation, to nearby Lewis Lockport Technical College where they could earn a degree and the A&P Mechanics Certificate in aviation maintenance, and for others to go into professional piloting. To this day Bob Blacker, when at a Chicago Airport, will occasionally hear a voice call "Mr. Blacker, Mr. Blacker" and find it is one of his old students, now in an airline captain's hat, or flying a corporation jet, or managing a repair station—each still carrying fond memories of his first contact with aviation. As a matter of fact, Blacker still keeps a photo of the *Baby Ace* in his wallet, along with pictures of his wife and five children. And in his files is a letter from the pilot who subsequently bought the airplane, congratulating Blacker and his students for the excellent workmanship.

After the success of that first *Baby Ace*, St. Rita's students built two other flyable aircraft more or less from scratch under Blacker's tutelage, before he left teaching to join FAA as a maintenace field inspector in 1961. One of these was a prototype (*EAA Biplane*) which now rests in the EAA Museum at Hale's Corner, Wis. Blacker is now Chief of the Maintenance Branch in the General Aviation Division of Flight Standards at headquarters in Washington, D.C.

Since 1957 the idea of building an aircraft as a high school class project has spread across the nation. Over the past 20 years an estimated 3,000 students in 125 schools have participated in airplane building, under the "Project School Flight" program conducted by the Experimental Airplane Association. Sixty-three aircraft have been completed in shop, industrial arts, science or aviation classes with other subjects, such as math, English and social studies, tagged as required background. Depending on the number of students and the time spent daily, the project can take from one to three years to complete; most are finished in two years.

Schools usually get started on airplane building projects because of the prior involvement of a teacher or parent in flying. Project costs vary, depending on the model chosen for building, and whether the parts will be new or used. For the current project at Norfolk's Lake Taylor High School, all the parts—including the Volkswagen engine and the propeller—were new, and the total cost ran about $3,800.

Financing the project, which is often the most difficult task, is managed in various ways. Some school budgets allow for buying aircraft components in units, as needed over a two year period. The finished airplane is then sold and the money plowed back into future such projects. In some cases local businessmen lend or give money for the first project. Some school projects have sponsors —individuals who pay for all the parts and then get the finished airplane.

Most first-time builders simplify their project by obtaining the detailed construction plans that are readily for sale. Usually a discount is made for schools; the plans include drawings, photos and exploded views as well as full-size rib drawings and a complete parts and materials list. Material and assembly units can be bought as needed, or

OPERATING LIMITATIONS

Aircraft for which a special purpose airworthiness certificate has been issued must be operated within operations limitations specified by the FAA Flight Standards field office. These include the requirement that the pilot-in-command hold an appropriate category/class rating, an aircraft type rating, and a current flight instructor's logbook endorsement. Flights may be confined to a given geographical area, certain hours of the day, and certain weather conditions.

Wing is fitted to the *Sonarai II* by Lake Taylor students aided by EAA members Henry Proescher, left, and Dick Robbins at wingtip. Above, teachers and advisors pore over plans during an evening session at Lake Taylor.

At Norfolk's Maury High School, where a *Bede-5* is being built, an absorbed student stays late to finish a unit of construction.

all at once. To a limited extent, some portions of the aircraft may be assembled from a kit. These may include the landing gear, fuel tank assembly, instrument panel, cockpit accessories, engine, and propeller.

Some schools, like Bay View High School in Milwaukee, develop a unitized curriculum for the "Airplane Construction Course" in their Industrial Arts Department. Students at Bay View get one credit per semester for two periods daily. Prerequisites are one year of drafting and a semester each in Wood Shop and Metal Shop. The Airplane Construction Course is offered in 14 units, as follows:

Aircraft Theory and Practice Introduction
Woodwork
Welding Steel Structures and Fittings
Welding and Heat Treating
Aluminum Alloy Structure and Fittings
Sheet Metal, Steel, Terneplate, Aluminum and Aluminum Alloy
Covering Fabric and Stressed Skin
Landing Gear Assembly
Electrical Systems
Instruments and Appliances
Assembly and Rigging
Aircraft Cable
Controls and Control Surfaces
Inspection of Certified Aircraft

Building an airplane at school seems to be one of those projects where everybody ends up a winner. The students gain satisfaction because meaning is added to their studies. This results in increased interest and motivation, and also better grade performance, attendance and student attitude—all of which makes the parents and teachers happy.

So You Want to Build an Airplane?

Suppose you are a school teacher interested in an airplane-building project for your class. Where do you go for advice and help? A good place to start is with two FAA Advisory Circulars published on the subject. Free copies are available from DOT/FAA Distribution Unit, TAD 443.1, Washington, D.C. 20590.

"Certification and Operation of Amateur-Built Aircraft," AC 20-27B, explains the responsibility of FAA in certificating amateur-built aircraft—as well as the pilots who are to fly them. It tells what kinds of materials may be used, what kind of testing must be done, what instruments are required, etc. It also explains the proportion of the work that actually must be fabricated by the class, and to what extent pre-assembled parts or kits may be used, in order to qualify for the required certificate; and the kinds of records that must be kept.

A truly amateur-built aircraft may qualify for an "experimental" certificate, which indicates that this particular aircraft has been designed and built, for purposes of education, and that the workmanship was accomplished in a manner compatible with industry practices. (Commercially manufactured aircraft require a "type" certificate, the acquisition of which is a time-consuming and expensive process involving careful testing at every step. Acquiring an experimental certificate may, if the appropriate procedures are followed, involve only two or three visits by an FAA inspector, essentially before critical areas are permanently covered and before the aircraft is flown.)

It should be noted that the "Special Airworthiness" certificate for experimental aircraft is concerned primarily with the quality of workmanship and materials, and does not certify the extent to which the aircraft will be controllable in flight.

The FAA field office with primary responsibility for aircraft certification is the Flight Standards Engineering and Manufacturing District Office (EMDO), but if an EMDO inspector can not conveniently work with the class his authority may be delegated to an airworthiness inspector in a Flight Standards District Office.

FAA maintains over 100 Flight Standards field offices throughout the country. Contacting the district office is a good first step in launching the class project. One meeting with the inspector will probably answer most of your questions.

The location of your nearest field office is given in Advisory Circular 20-86 "Aviation Education Through Building an Airplane."

This circular contains a wealth of general information and source references for the raw beginner in aircraft construction, including the names of schools that have completed successful plane-building projects, and which may be contacted for advice and suggestions—or visited.

Another useful contact is the state aeronautical authority. Most states have some form of aeronautics Commission or Aviation Department with some resources to assist school projects. The titles and addresses of these organizations are given in this circular.

A non-governmental organization which is very heavily involved in amateur aircraft building is the Experimental Aircraft Association of America (EAA), with some 72,000 members and over 415 active chapters throughout the world. (A fantastic display of antique and homebuilt aircraft takes place every year at EAA's annual fly-in at Oshkosh, Wisc.—the dates this year are July 31 to August 8).

EAA has "technical representatives" in most communities who are experienced in building aircraft and will lend a hand in school projects. To obtain the name of the nearest such "tech-rep," contact the Aviation Education Division of FAA's Office of General Aviation in Washington, D.C. This office also has a variety of interesting literature available free that may be of interest to students with an eye toward the sky.

Incidentally, a filmed version of a school plane-building project from start to test flight is available on loan from the FAA film Library, AAC-44.5, P.O. Box 25082, Oklahoma City, OK 73215. Ask for "The Wind is Right."

Planners of a school-built airplane are advised to obtain or be familiar with the following Federal Aviation Regulations:

Part 1. Definitions and Abbreviations, $3.00.
Part 21. Certification Procedures for Products and Parts, $3.75.
Part 45. Identification and Registration Marking, 65¢
Part 47. Aircraft Registration, 85¢
Part 61. Certification, Pilots and Flight Instructors, $2.90.
Part 91. General Operating and Flight Rules, $11.30.

Prices shown are effective as of June 15, 1976 and are subject to change without notice. Please add 25% for foreign handling. Send check or money order (not cash) to Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Vital Actions

In an emergency one wrong action leads to another

They were flying through a mountain pass at 8,000 feet when the big 300 hp engine of the Cessna 207 cut out suddenly. The pilot immediately moved the fuel selector from the right tank to the left, and turned on the electric fuel pump. The engine roared back to life—to the vast relief of the pilot and his six passengers, who settled back in their seats and regained their composure. They were on a holiday trip to a lake resort in the mountains.

According to the pilot's calculations, backed up by the panel fuel supply indicator, the right tank should not have run dry yet. But as a precaution, he landed at the first convenient airport. Before getting out of the airplane he switched back to the right tank and started up the engine. It appeared to run perfectly on the ground. He decided to have a mechanic check the fuel lines for possible blockage; and as it was nearly noon he sent his passengers into the airport terminal to have lunch.

It was two o'clock before a mechanic was free to help him, and by that time the pilot was getting restless about the passage of time. He asked the mechanic to sit in the cockpit with him and run the engine while moving the fuel selector from one tank to the other. Everything seemed normal now, but the pilot explained what had happened at the pass, and why he suspected some kind of blockage.

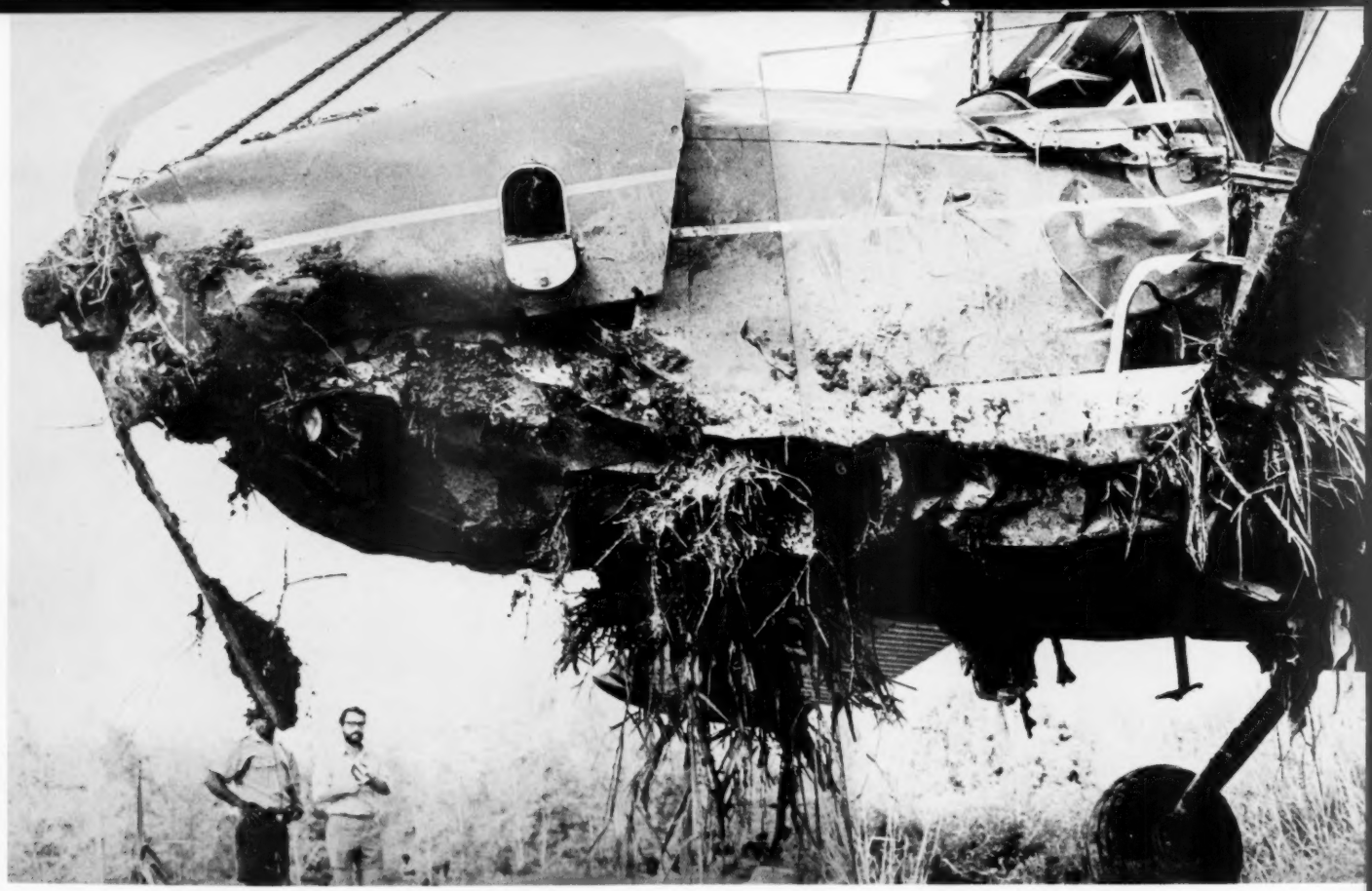
The mechanic listened to the engine carefully, then shut it down, climbed out and checked both tanks with a dipstick. The left tank was nearly full; the right tank was virtually empty. He explained to the pilot that the tank contained a gallon or two of "unusable" fuel which was not available to feed into the system during level flight. However the maneuvering of the airplane during the approach and landing sloshed around enough fuel to fill the emptied lines from the tank to the selector valve, and this fuel was sufficient to run the engine for about five minutes. (This is why pilots trying to make it down to an airport with near-empty tanks will rock the wings to drain out the last ounce of fuel.)

A Critical Omission

The pilot accepted this explanation of his problem gladly, since it meant no further loss of time and he was eager to reach his destination before nightfall. In view of the fact that the temperature was now into the 90s, and he had a full load of people, he decided against taking on any more fuel at this point. He could stop and refuel after passing the last range of mountains, if necessary. He rounded up his passengers, who had scattered about the terminal, and asked the tower for clearance to depart. Without bothering to run-up, he rolled the *Skywagon* 207 onto the runway as soon as he received his clearance and took off.

The takeoff appeared to be quite normal, with the aircraft lifting off about halfway down the north/south runway and commencing a standard climb. At a height of about 400 feet above ground the aircraft began a gentle turn to the left, but instead of straightening up on that heading the turn was continued around toward the direction of the runway. Simultaneously the pilot radioed the tower, requesting a straight-in approach and transmitting "Mayday." Superimposed on the pilot's transmission could be heard the aircraft's stall warning horn sounding in the background.

The controller immediately instructed a Fokker *Friendship*, which had just been cleared for takeoff, to hold position, and cleared the *Skywagon* to return to the runway he had just departed and land in the opposite direction. Asked about the nature of his difficulty, the pilot replied that he had "fuel blockage," and again the sound of the stall warning horn could be heard during his transmission.



At about this time several persons on the ground in the area south of the airport heard the sound of an erratically running engine, and they saw the *Skywagon* making an unusually low and shallow approach to the main runway from the south. After narrowly missing a small stand of pines a mile out from the runway threshold, the aircraft turned slightly to bypass a school building at a very low altitude, and continued on in the direction of the runway.

Then abruptly all engine noise ceased and the aircraft disappeared below the elevation of the airport into a clump of willows growing on the southern bank of a deep narrow creek. One elevator was torn off, and apparently in a stalled condition the *Skywagon* came over the creek and impacted heavily in a nose-up attitude against the opposite bank, 800 yards short of the runway. The pilot and three of his passengers were killed on impact. The remaining three passengers were seriously injured.

During the subsequent investigation the aircraft's fuel selector was found positioned to the righthand tank, which was, of course, empty. The left tank was also empty at the time of inspection, but it had obviously been ruptured in the impact and showed evidence of having contained a considerable amount of fuel at the time of the crash. The fuel system itself was virtually devoid of fuel, but a careful examination of the system and the engine failed to reveal any impediment to normal flow. It was concluded that apart from the positioning of the fuel selector to the empty righthand tank, the aircraft should have been capable of normal operation.

It was learned that before the initial takeoff that morning, the pilot had filled the lefthand tank to capacity, but because of the full load and the high density altitude anticipated en route he did not top off the righthand tank. Either he was mistaken about the actual amount of fuel placed in that tank, or he miscalculated the rate of fuel consumption for the conditions of the flight—in either case, the "usable" fuel in the tank had been exhausted by the time he reached the mountain pass (where strong headwinds had been reported).

Later he had been able to start and run the engine on the ground with the fuel selector turned to the (empty) right tank, for the reasons given by the mechanic—i.e., enough "unusable" fuel had trickled down into the system during the landing and takeoff maneuvers to operate for four or five minutes.

During the checkout of the system on the

Above—the force with which the aircraft impacted the ground was clearly evident when the crumpled *Skywagon* was hoisted from the accident site during the investigation. Left—Goroka Airdrome, in north Australia showing flight path and scene of the crash.
Photos courtesy of *Aviation Safety Digest*.

KNOW WHAT TO DO

What a pilot does in the first few seconds following an inflight emergency, such as an engine failure or fire, can be literally a matter of life or death. The stress associated with the imminent possibility of a forced landing can result in erratic thinking or poor judgment, leading to a serious accident, unless you have a specific series of actions to carry out, in a given order, as appropriate to the emergency situation. (Some of these actions may have an opposite intention: with engine failure you want to immediately assure an unimpeded flow of fuel to the engine, whereas with an engine fire you would want to arrest that flow at once.)

A checklist of step-by-step procedures for the more common emergencies should be carried in your flight kit; these are usually provided by the manufacturer and found in the owner's manual. They should be practiced, in a safe environment, until they become virtually automatic. For engine failure, critical items to be checked should include:

- Position of the fuel selector.
- Fuel pressure gauge (to see if fuel boost pump is needed.)
- Mixture control.
- Position of magneto switch.
- Carburetor heat.

ground, the fuel selector had been moved repeatedly from right to left and back. In his haste to depart the pilot had not taken the time to observe that it remained on "right"; he assumed he was drawing from the full tank on takeoff, so that when the engine began to misfire at a critically low altitude he saw no reason to switch to the alternate tank, which in his mind was the empty tank. In this crisis his earlier assumption of "fuel blockage" jumped back into mind, and distracted him from checking the selector visually. Banking the aircraft to turn back to the field evidently dribbled a few more drops of fuel from the empty tank, which accounted for the intermittent firing of the engine before it stopped altogether.

In view of the facts turned up in the investigation, the tragic accident appears to be a simple case of fuel exhaustion, the result of one unfortunate pilot error compounding another. It was a serious mistake to take off without going through the checklist and making certain that the fuel selector was directed toward the full tank. (The aircraft is placarded against taking off with the selector in any other position.) The second mistake was the failure of the pilot to go through a standard restart procedure when the engine failed shortly after takeoff, and his reliance instead on a guesswork diagnosis of "blockage."

These two errors led to the forced landing, but they did not dictate the fatal aspect of the accident. The investigators concluded that even if the engine had not been restartable, a survivable landing might have been made if the pilot had immediately carried out the standard procedure for establishing control of the aircraft under these circumstances: keeping the airplane on a straight course and establishing a normal glide angle. At the point of engine failure, the *Skywagon* had attained a height of about 400 feet, and had traveled some 3,000 yards beyond the end of the runway. The owner's manual for this aircraft shows that from this height the aircraft would have been able to glide only about 1,100 yards. Thus from the point of engine failure a return to the runway with a dead engine was clearly beyond the capacity of the aircraft.

The terrain along the takeoff path to the south of the airport is rough and crisscrossed by steep-sided gullies—it is not an ideal landing area. Even so, there are reasonably flat areas between the gullies, well within the aircraft's gliding range. They would have afforded the opportunity for a relatively safe landing—if the pilot had retained control of the aircraft.

The fact that the stall warning horn could be heard continuously during the two radio transmissions made after the engine failed indicated to the investigators that the pilot did not adopt a safe gliding speed, possibly because he was attempting to stretch the glide back to the runway. The crash site impact was over 2,000 yards from the point of the engine failure, which suggests that the pilot was able to obtain some assistance from the fuel-starved engine during his obviously desperate attempt to regain the airport. But he crashed 1,000 yards short.

The tragic consequences of his effort add up to a sobering lesson on the folly of trying to save the airplane at the expense of the occupants. In an emergency it is the pilot's responsibility to put the aircraft down *with the least possibility of injury to his passengers and himself*. Setting up a normal glide not only affords the pilot control of the plane, but it also helps to retain his own clarity of mind—in the case of the unfortunate *Skywagon* pilot it might have given him an opportunity to glance at the misdirected fuel selector.

A large proportion of emergency landings with engine failure are due to fuel starvation, despite the presence of adequate fuel on board.

Certain actions in the checklist of emergency procedures are often referred to as VITAL ACTIONS, which must be carried out at once to assure control of the aircraft. The outcome of this accident makes it clear why they are so called.

(Based on an article in Volume 93 of the Aviation Safety Digest, published by the Australian Department of Transportation, and produced here with the approval of that Department. The actual accident took place in northern Australia.)

The Fire Fighter

Aviation progress during these past seventy years has often been quickened as the result of tragic accidents which challenged inventive minds to develop improved aircraft and equipment.

Two fatal accidents, both of them involving deaths directly caused by fire in the cabin, gave William A. Enk the motivation and the determination to pioneer a fire suppression and fire prevention system for general aviation aircraft. His original work in this field earned him the honor of national winner of FAA's Aviation Mechanic Safety Award for 1975, in the general aviation category.

The first of those fire accidents occurred to a close personal friend of Enk, an airline pilot who was flying in the San Diego Air Races in 1971. The pilot, a promising young man of 33 with a wife and three children, had just been named a captain for TWA. On the day of his fatal accident he was flying in a recently-purchased *Bearcat*, a World War II Navy fighter.

Because the race that day was filmed, that evening Bill Enk had the horrifying experience of watching his friend's airplane burn up in the sky—on the TV screen. The film showed the *Bearcat* streaking along at an altitude of about 100 feet when the engine suddenly burst into flames. The fire was thought to have been caused by a "blown jug," a cylinder which blew up, probably from too much pressure in that ancient engine. The pilot immediately pulled up, slowing the airspeed and getting up to about 1,500 feet. The fire was still confined to the blazing engine, and he was lowering his wheels in an attempt to make a fast landing.

But as the wheels were lowered the fire jumped to the wheel well area. There were now flames in front of the pilot and under him, and when he put the nose down the flames swept back over the cockpit. The *Bearcat* continued straight down in its dive, the pilot unconscious, overcome by the smoke and flames, despite the fact that he had been wearing an oxygen mask. He was killed on impact.

Watching that film was an emotionally searing experience for Bill Enk, one which was to haunt him for a long time to come. He knew that his friend had possessed the flying skills needed to bring the disabled airplane down, but the fire had simply spread too quickly. There was no fire extinguisher designed for small aircraft that would have been able to extinguish that volatile fire safely.

For the next few years aircraft fires and fire suppression devices were to command a lot of his thought and time.

Bill Enk was only 29 years old himself at the time of his friend's death, but he had already amassed an amazing set of aviation credentials for a man so young. Born in Chicago, he developed an early interest in powered model airplanes, and he began taking flying lessons at the age of 16 at the old Waukegan Airport. He made his first solo in a Piper J-3, even before he had obtained his driver's license, and he received his private pilot certificate when he was 17.

After obtaining a B.S. degree in Aircraft Maintenance Engineering from Parks College of Aeronautical Technology, as well as an A & P mechanic's rating, he worked as an aviation mechanic before entering the Air Force. From 1964 to 1968 he served in the Air Force, mostly at Wright-Patterson AFB in Ohio where he had the rank of captain and was an Aeronautical Structures Engineer, conducting flight tests and studies to evaluate the loads and structural response of aerospace vehicles which might be exposed to nuclear detonation.

He left the Air Force to join TWA where he was to work for the next few years as a flight engineer on Boeing 727's, a position that demanded a pilot's license at the time. During those years he was also putting in extra hours to increase his aviation proficiency. He earned his I.A. mechanic's rating, as well as his ATP and Instrument Flight Instructor licenses.

By the time of the San Diego accident in 1971 he had his own business, Enk Aviation in Blue Springs, Missouri, an aircraft sales and service business. His wife, Mary Terese,

ran the office for him while the pilot-engineer continued to work in the shop, using his A & P and I.A. ratings to inspect, repair, and alter aircraft.

But after his friend's death he began to spend more of his time studying the problem of aircraft fires. NTSB statistics for 1971 showed him that whenever fire-after-impact occurred in general aviation, about two thirds of those accidents were fatal.

(Actually, the latest full statistical analysis of general aviation accidents produced by NTSB, for the year 1974, shows an increase in those figures. In 1974, there were 360 fire-after-impact accidents out of the overall total of 4,425 accidents that year, about eight percent of all accidents. But of those 360 accidents, 266 were fatal, a total of about *73 percent.*)

In addition, Bill Enk did some statistical research of his own with NTSB records. Working through mounds of statistics and reports he learned that only 60-70 percent of all inflight fires began in the engine compartment; the other 30-40 percent either started in the cabin or ended up there.

He concluded that what was needed for general aviation aircraft was some system which would quickly flood both the engine compartment *and* the cabin. There were a number of good engine flooding systems on the market, but he felt that the fire fighting apparatus available for the cabin left much to be desired.

The problem, he concluded was that the usual principal ingredient of most extinguishers available was CO_2 an inert gas which blankets the fire and smothers it by depriving it of the oxygen required for combustion. That worked fine in the engine area where there were no people, but a massive discharge in the cabin area could deprive the passengers of the oxygen they needed to breathe. There were also carbon tetra chloride extinguishers, but the chlorine element could combine in combustion to form highly toxic gases resembling phosgene, sometimes used as a war gas.

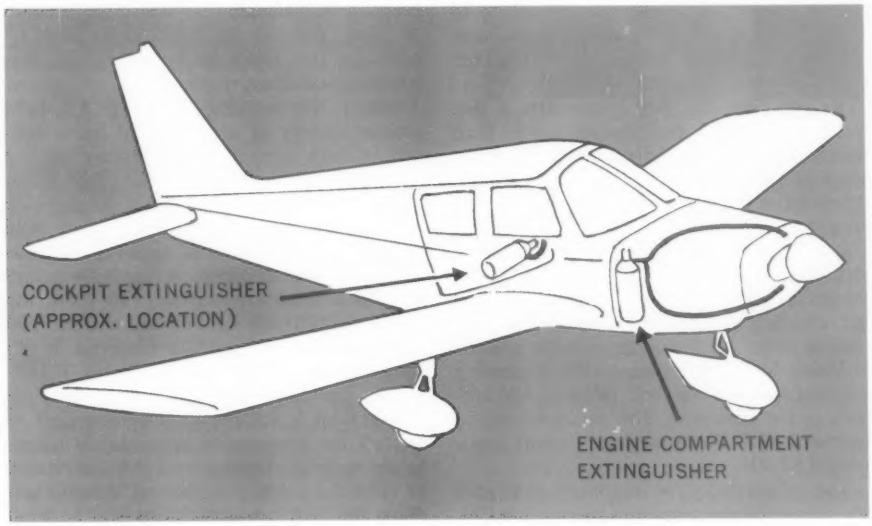
Enk found the agent he needed for a cabin system quite inadvertently.

One night he was having dinner at a restaurant with a friend, Les Fike, president of a specialty metals company. Fike mentioned that he was starting to supply a fire suppressant system employing a commercial compound which was becoming increasingly popular with boat owners—a gas called Halon 1301, an extremely fast acting fire suppressant. It was particularly effective when a fire broke out in the cramped engine compartment of a boat because it was not toxic in low volume mixtures with limited exposure and it did not deprive people of oxygen.

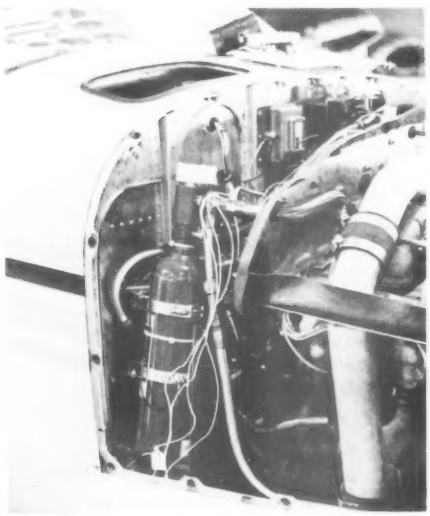
That was all Bill Enk had to hear, and the next day he set out to find whatever he could about Halon 1301. He discovered that it is a colorless, odorless gas ($CBrF_3$ bromotrifluoromethane) which stops the combustion process itself by chemical reaction, and it had been available for about ten years. The chemical was credited with extinguishing most shipboard fires in a matter of seconds. Tests had indicated that it was non-toxic to people in enclosed areas, in the low concentration used on boats. Only a five percent concentration by volume was required, as compared to the 40 percent concentration by volume required by most carbon dioxide extinguishers.

Enk consulted with the manufacturers of Halon 1301, explaining his interest in their product, and they assisted him as he made his calculations about using it in an engine and cabin flooding system for small aircraft. He also consulted with the FAA Engineering and Manufacturing District Office in Kansas City, as well as the engineering branch of FAA's Central Region.

Working with Fike, Bill Enk developed a five-pound container, or bottle, for the chemical with a push button activator. When the "Fire" button was pressed, an electric current was supplied to a detonator which blew open the disk valve seal. This was timed to take place within four milliseconds. The Halon 1301 was then released through discharge nozzles over a period of two full seconds—any shorter release period, Enk believed, might permit re-ignition of the fire. His system for a single engine aircraft



Fire suppresser for single engine aircraft uses two five-pound fire bottles (in cabin and engine compartment) that activate manually or by heat sensitivity: at 180° a frangible diaphragm ruptures, releasing the suppressant. Concerned, however, that dazed occupants could be overcome by heat and gases before temperatures reach 180°, Enk is now working on an optional feature to activate the system on heavy impact, perhaps linked to the ELT G-switch.
Photos by Chuck Caster, Wichita FSS



called for two bottles, one in the engine compartment, the other in the cabin.

After he had worked out the design to his own satisfaction, Enk visited FAA's Civil Aeromedical Institute staff in Oklahoma City and demonstrated that the amounts of Halon 1301 he was releasing in the cabin would not be toxic to human beings. The system was first flight tested on Enk's Beech T-34 *Mentor* for FAA's engineers in Missouri.

After exhaustive tests and analyses, the Engineering and Manufacturing Branch of FAA's Central Region issued Enk a Supplemental Type Certificate for the Beech installation. But Enk had larger plans than the installation of his system on just one aircraft model; he wanted to engineer it for all commonly used aircraft.

It was while he working on those plans that he was a witness to the second fatal fire accident which made him even more convinced that he was on the right track. On a Sunday afternoon in July 1974 he had just arrived at McComas Airport in Lees Summit, Missouri, when he saw a single-engine *Maule* coming in for a landing. There were crosswinds of about 10 to 12 knots and as the airplane descended it first touched down on the right main wheel, and then bounced up in the air about 15 feet. The wings wobbled as the pilot appeared to apply more power. Then it came down on its tail wheel and skidded along the runway for about 150 feet until it ran off the runway.

The out-of-control *Maule* narrowly missed Enk's own T-34 which was parked there and which he planned to take up for a flight. The pilot was desperately trying to avoid a collision as he fought to bring his airplane to a stop. It missed a parked trailer, some other aircraft, and even the gas pumps. But finally it hit a parked Cessna, and slammed into a row of trees.

For a moment it appeared as if the crash was going to be survivable. There were four persons in the airplane, two men in the front seat, and two women in the rear. As Enk ran toward the airplane the two men were already out of the cabin, trying to drag out the two women, who were alive and moving.

But then—about 25 seconds after the initial impact with the trees—there was what one witness described as a great "poof," an enormous sound when some of the spilled gasoline from the broken wing tank ignited. The flames shot up over the plane immediately, as the two men frantically sought to extricate their wives, but were driven back by the flames. Their clothes on fire, they fell off the airplane, writhing with pain.

By the time the fire truck arrived one woman was dead, the second dying. Both husbands survived, badly burned. The anguish of the survivors spurred Enk on in his efforts to perfect a foolproof system for suppressing crash fires.

By late 1974 he was able to obtain a Supplemental Type Certificate for his engine-cabin systems on a series of general aviation aircraft, both single and multi-engine, including some of the most popular models of Piper, Beech, and Cessna. His dispensing system has been installed on over 100 aircraft in the past year. This basic two-bottle system for a single engine aircraft costs around $1,000.

The unreliability of manually activated fire suppression systems was proven for Enk by an incident involving two of his friends who owned a Lockheed *Lodestar*, equipped with a conventional CO_2 engine fire suppression bottle. Shortly after Enk had persuaded them to let him add a heat detector mechanism to the system, they experienced an in-flight fire in the *Lodestar's* left engine. Their first indication was the heat detector's warning light on the panel; there was no smoke or malfunction and all of the gauges appeared normal. The two pilots were reluctant to believe the warning light until one of them noticed the paint on the cowling starting to blister—then he fired off the bottle in a hurry, and they were able to land safely. An investigation showed that the fire had already begun to penetrate the firewall of the engine's accessory section before the suppressant was released. A few more seconds of delay, and the fire could easily have ignited the fuel tanks in the wing, with perhaps tragic consequences.

Enk is still working to gain STC's for a greater variety of aircraft, and he is consulting with aircraft manufacurers on the value of manufacturer-installed cabin flooding systems like his. He has set up shop for installing fire suppression systems at Blue Springs, Missouri, where he lives with his wife and two children. As a hobby, and relaxation from his busy days of crusading about aircraft fire, he restores antique and classic aircraft, and he also performs in airshows and acrobatic contests in his T-34A.

Enk himself is the first to admit that his new system is not the final achievement in aircraft fire suppression systems, but it certainly is the first one ever FAA certificated to flood the cabin of a general aviation aircraft. Bill Enk saw a problem, and he went to work to do something to correct it.

THE SUGGESTER: Oil Rigger to Airplane Fixer

LaVerne L. Gondles, an aviation mechanic for American Airlines in Tulsa, Oklahoma, is the winner of the award in the air carrier category. He was cited for his high level of competence, including some 30 suggestions for improved techniques and modifications which have been adopted by American Airlines as well as other airlines.

That American Airlines' 260 acre Tulsa maintenance center, with its hundreds of highly skilled technicians, should produce the nation's top air carrier mechanic (as judged by FAA's Mechanics Safety Award Program) two years in a row is not in itself unusual. What is surprising is that the recipient of this award, LaVerne L. Gondles, is relatively new to aviation, moving into it as a second career after a successful 30 year hitch in the Oklahoma oil fields.

Gondles was born in the little cattle town of Skiatook, Okla., in 1918. After high school he became a "roughneck" in the oil fields, worked hard, and despite his lack of training showed mechanical flair working with the rigs and drills all over the southwest. Eventually he worked his way up to field foreman, supervising contracts that often took him away from his wife and three children for weeks or even months at a time. But it was a good job, and one he felt comfortable in.

His only association with aviation during all those years was a few months' stint during World War II, when as part of the war effort he worked as a mechanic in Douglas' Modification Center, then in Tulsa. It was his first contact with large aircraft, and he liked the big machines, the powerful engines, the multiplicity of parts. But he was an oil man basically, and after the war he continued to work in that field.

Finally it was 1966, and he was 48 years old. His three children had completed their education and moved on, and he had become a little footsore and weary from all of the

The 260-acre American Airlines Maintenance and Engineering Center at Tulsa—shown above during American's 50th Anniversary celebration in April—has produced two winners in a row in the air carrier category of FAA's Mechanic Safety Award Program.

travel he was obliged to do in the pursuit of oil. He heard that American Airlines in Tulsa was looking for mechanics. He recalled his fascination with those big airplanes some 20 years earlier, and he felt he had enough experience with different machinery to qualify.

The airline agreed, and placed him in the compressor shop, utilizing his experience with compression engines. His new career had begun.

Over the next 10 years he was shifted to a number of different shops where he worked on valves, fuel control, and electrical accessories. In the evenings he used a home study course to earn an FAA Airframe and Powerplant rating.

Gondles soon acquired a reputation in the shop as "the suggestion man." In 1969 he pointed out that certain diaphragms in the air conditioner system regulator valves on a Boeing 727 which were routinely replaced at an arbitrary interval could be inspected and reused if sound. This was followed by a series of suggested improvements for pneumatic and electrical actuators, including one which eventually solved the latching problem on the cargo doors of the DC-10—a modification now being used by all DC-10 aircraft throughout the world.

Gondles' suggestions are the result of long and patient study of the piece of machinery on which he is working, followed by a mental review of other pieces of machinery he has worked on over the years to see if any other techniques or procedures might be adopted to aviation mechanics. This blend of curiosity and creativity has resulted in 28 adopted suggestions and won him cash bonuses from his own airline, as well as the respect of the manufacturers and other airlines which have adopted his modifications.

Both Gondles and Enk were honored in a ceremony at FAA Headquarters in Washington on June 22 when they received specially inscribed medallions, in addition to monetary and other gifts furnished by manufacturing firms and aviation organizations.

These two finalists were selected from among the 24 Regional winners, by a special panel of the Flight Safety Foundation.

BRIEFS

COCKPIT DISTRACTIONS, INCLUDING the need to respond to radio transmissions, are cited as a major potential cause of landing or takeoff accidents by the Special Air Safety Advisory Group which has concluded a four months observation of inflight conditions on the nation's airlines, at the request of FAA. The group, made up of experienced airline captains, suggested that the use of boom microphones (instead of hand-held mikes) would greatly increase safety during these critical stages of flight. The recommendation also applies to general aviation.

■ THE BIG SLEEP. A recent fatal crash of a light twin on a scheduled air taxi "courier service" run in Ohio apparently occurred after the pilot dozed off near the end of the flight. On an IFR flight plan, he had been cleared for an ILS approach and instructed to descend from 7,000 feet to 4,000 feet. He failed to level at 4,000, however, and crashed between the outer marker and the airport. Another pilot recalled that the air taxi pilot had told him he became progressively more tired toward the end of a week of night flights. The National Transportation Safety Board could find no certain cause of the accident, speculated that the pilot, like his companion (who survived) had fallen asleep.

■ TORQUE TWISTERS ALERT. Pilots who choose to perform allowed "preventive maintenance" on their aircraft are cautioned that torque wrenches--such as those used for changing spark plugs--may become progressively inaccurate as time goes on. Periodic inspection and servicing is necessary for accurate torque readings. Your dealer or manufacturer's representative should be able to advise you on where to have this done.

■ KEEPING HIGH AND DRY. A new FAA film on overwater flying for general aviation pilots has just been released to field offices. The film covers preparation for overwater flight, navigation, and ditching procedures. Pilots may request local showings from the accident prevention specialist at their local Flight Standards District Office, or from the regional Public Affairs office. The film, "Overwater Flying," is also available on loan from the FAA Film Library, AAC-44.5, P.O. Box 25082, Oklahoma City, OK 73125.

■ CANADIAN HOMEBUILTS. Special Flight Authorizations for operating Canadian amateur-built aircraft in the United States may now be issued regionally through local Flight Standards field offices. Such authorizations were previously issued only from FAA headquarters in Washington, D.C., but the excellent safety record of these aircraft has led to an amendment to Part 91 providing for regional issuance.

FEATHER POWER. Airport officials in Sydney, Australia, are using falcons to drive away seagulls from the vicinity of the airport. Reportedly the presence of the fierce hunters is enough to discourage many local birds from nesting nearby.

GENTLE GREEN GIANT. How do you go about moving 60,000-pound bulk oil storage tanks nine miles across town? When Southeast Grease and Oil Company needed to move from South Omaha to North Omaha they called in Evergreen Helicopters, Inc. of McMinnville, Oregon, who sent a huge green Sikorsky S-64 Skycrane "Gentle Giant." After two months of planning and coordination with the FAA Tower and GADO, local and state police and city officials, the project got underway early on a Sunday morning. Seventeen times the "Gentle Giant" rumbled along a route that followed the railroad tracks and the Missouri River, carrying pre-cut tank sections, some of which weighed 19,000 pounds and were wider than a city street, while police stopped surface traffic on overpasses and bridges. In eight hours a total of 250,000 pounds had been moved. The job would have taken an estimated 30 days by surface transportation.
Photo by Lincoln, Neb. GADO

FAA Recommendations for Coping With Wind Shear

"Low Level Wind Shear" is the subject of a new FAA Advisory Circular (AC 00-50) which provides guidance for recognizing the phenomenon before and during flight and also describes pilot techniques to minimize its effect on takeoffs and to help prevent short or long landings.

Wind shear is a change in wind direction and/or speed in a very short distance. Under certain conditions some dramatic wind shears can occur close to the ground.

Flight conditions associated with windshear can vary from troublesome to hazardous. If you experience sensations of wind shear when flying (unusual airspeed fluctuations or power requirements) report the location and altitude where they occurred to the tower or nearest ground facility, so they can alert other pilots.

Copies of AC 00-50, "Low Level Wind Shear" are available free from DOT/FAA Distribution Unit, TAD 443.1, Washington, D.C. 20590.

Technical Aviation Reports Listed

An updated list of 56 scientific and technical reports that are available to the public has been released by FAA. The list includes reports on aircraft safety, airports, air traffic control, communications, environmental quality and navigation, and includes prices and instructions for ordering.

The list is available free from FAA, Office of Public Affairs, APA-300, Washington, D.C. 20591.

New Thunderstorm Alert Tested

A new procedure for alerting pilots to the presence of thunderstorms near airports is being tested by FAA and the National Weather Service at five of the nation's busiest airports: La Guardia, JFK and Newark Airports in New York, Washington National, and Philadelphia International.

When a strong thunderstorm is spotted on radar within 30 miles of one of the test airports, observers at National Weather Service stations will notify the meteorologist at the FAA Central Flow Control facility in Washington. FAA will then pass along information on the storm's location, intensity, height and movement to the appropriate air traffic control facility for relay to pilots in the affected area.

Test results over a five-month period will be evaluated by FAA and the Weather Service. Pilots and other interested persons may send written comments to FAA, AAT-370, Washington, D.C. 20591.

Special Traffic Pattern for EAA

In anticipation of heavy traffic, FAA has announced special air traffic procedures for the Oshkosh area during the Experimental Aircraft Association Fly-in, July 31 through August 8. During this period Oshkosh Tower will operate on a 24-hour per day basis.

For the most part pilots will receive instructions by monitoring the radio and following directions from flagmen on the ground. Inbound pilots should listen to ATIS on 128.5 at least 30 miles out for landing information. Departing aircraft should monitor ATIS on 125.8 before taxiing.

To operate in the area all aircraft must have radios; exceptions are experimental and vintage aircraft for which waivers have previously been obtained from the Oshkosh Tower. Complete instructions and a diagram are included in the July 15 issue of Airmen's Information Manual, Part 3A.

GA Airport Noise Guide Issued

A noise planning guide for general aviation airports has been published by FAA to help operators make such airports better neighbors. Entitled "Developing Noise Exposure Contours for General Aviation Airports," the report presents simple procedures for estimating the noise impact of varying levels and kinds of aircraft operations at non-airline airports of all kinds—those with only a few daily operations on a single runway to a busy airport with several runways.

Copies of the report are available from the National Technical Information Service, 5284 Port Royal Road, Springfield, Va. 22161. Price per copy is $7.75 ($10.25 foreign). Microfiche copies are $2.25 and 3.75 respectively. (Make checks payable to NTIS.)

FAA GENERAL AVIATION NEWS welcomes comments from our readers. No anonymous letters will be used, but names will be withheld on request. Address: FAA GENERAL AVIATION NEWS, AFS-807, Washington, D.C. 20591.

• Dumb Pilots

I find it difficult to believe that FAA would fall victim to the old and extremely outdated concept of "dumb female pilots." I'm referring to your caricature by Osborn on the back page of March 1976 "FAA GENERAL AVIATION NEWC. Obvious long eyelashes, low-cut dress and cleavage identify the pilot-in-error as a woman; and you have, I feel, purported the "dumb female" role by dramatizing the reaction by the male pilots, who are, of course, correct.

People are people, whether male or female, and people make mistakes. By your caricature, you promulgate the belief that only "the wimmen make mistakes," which truly is fallacious.

Patty Calcaterra
Salem, Oregon

A tally of our past 18 issues shows that erring pilots have appeared in 13 safety cartoons. Twelve were pictured as men and one as a woman. We do not claim that this ratio is proportionate. It might be interesting to run a statistical analysis, when time permits.

No one can argue with your statement that "people are people." Our artist insists on drawing them as either men or women. Perhaps he is old-fashioned, but that is the only way he knows.

• Shooting from the Air

The May 1976 "National Geographic" magazine has a photo of a Piper *Cub* flying along with a dead coyote hanging from the wing struts and a shotgun aimed out the open window. The caption indicates that Montana sheep ranchers hunt coyotes "for survival, not sport." My question: Is it, or is it not, a Federal offense to discharge firearms from an aircraft?

Also you recently listed the status of the FARs. What has happened to the subscription (updating) service that used to go with Part 43? Also, does the present Part 43 now combine 43.13.1 and 43.13.2?

John Cadman
Vernon, Conn.

The Airborne Hunting Act, enforced by Fish and Wildlife Service, prohibits shooting from an aircraft "for the purpose of capturing or killing any bird, fish or other animal," with penalties up to $5,000 and/or a year in prison. However, there are exceptions for authorized agents or those operating under state or federal permit to "aid in the protection of land, water, wildlife, livestock, domesticated animals, human life, or crops." When states issue such permits they are expected to file annual reports with the Interior Department including animals taken and the reasons for issuing the permit.

Regarding your question on the FARs, when they were "de-volumized" recently, some of the FAR Parts that were seldom changed (including Part 43) were put on sale as individual Parts with a one-time price. If and when any future changes are made they will be sold separately, at a nominal fee, and these will be shown on our regular FAR Status sheet.

As for 43.13.1 and 43.13.2, these are still in existence but they are not part of the FARs. The numbers you list are Advisory Circular numbers for reference books on "Acceptable Methods, Techniques and Practices" of "Aircraft Inspection and Repair" and of "Aircraft Alteration" respectively.

• First Controlled Flight

Did you know that July 6, 1976, is the 40th anniversary of the en route traffic control aspect of the FAA's Air Traffic Service. On July 6, 1936, the Bureau of Air Commerce of the Department of Commerce took over from the airlines the Newark, Cleveland and Chicago en route Centers, involving a total of 15 air traffic controllers. These became the first Federal air route traffic controllers and the 15 were picked up as civil servants. In their first year of operation, 30,000 plus aircraft movements were controlled by these Centers. In addition, the Detroit Air Route Traffic Control Center was commissioned in 1936.

This would make a good subject for one of your historical articles.

Stanley R. Mohler, M.D.
Washington, D.C.

• Aging Engines

Your article about bad habits of flying that "age engines" (The Engine Doctor, April 1976) was most interesting. You named such things as frequent climbs at steep angles, abrupt throttle changes, etc. It seems logical these bad habits would age an engine, but I've heard experienced pilots, mechanics and manufacturer's representatives state that the worst thing you can do to an aircraft engine is baby it. Who's right?

E. Ray Ritch
Huntsville, Ala.

Both—and they need not be contradictory.

What harms the engine is allowing it to get too hot, which can occur if you idle at low rpms excessively—this kind of "babying" should certainly be avoided. Very steep climbs also build up heat, and rapid descents or abrupt throttle closure can cool a heated engine too fast. This, as the Engine Doctor noted, is also bad practice. But the use of full power on takeoff, and as otherwise permitted by the manufacturer's recommendation, will do no harm as long as engine temperatures are not excessive.

• Poor Man's Landing Aid

In your April issue you refer to the "three-board VASI" (visual approach slope indicator) as "undergoing evaluation." This is not a new idea. For instance "POMOLA" or "Poor Man's Optical Landing Aid" has been around since at least the 1950's when the above name was coined in deference to the mirror optical system used to land jets aboard aircraft carriers.

When are we going to stop evaluating and start installing?

Lewis W. Whitaker
Wilton, Conn.

The present project is the first FAA evaluation of a low-cost visual landing aid. Bear in mind that FAA does not install such equipment at airports. What FAA does is to study the equipment and approve (or not approve) it for eligibility in a Federally funded project. (The three-board VASI at many airports in Maryland, such as the one we pictured in an earlier issue, were installed at state expense.)

INSTRUMENT CORNER

• On Top

Is an instrument rating required for flying "VFR over the top" or "VFR on top"?

Weathered In
Los Angeles

No and yes—in that order. The terms you mention refer to two entirely different types of operation. "VFR over the top" is flying above clouds, in VFR weather conditions and not on an IFR flight plan. If you are able to remain in VFR conditions at all times during your flight, including the climb and descent, you do not need an instrument rating.

On the other hand "VFR on top," sometimes called "VFR conditions on top," refers to an instrument operation requested by the pilot (in lieu of an assigned altitude) when he files his instrument flight plan. (If filing in person enter "OTP" in the altitude block of the flight plan.) Under certain conditions this type of flight plan provides a convenient way for an instrument-rated pilot to fly above the clouds, especially if the tops are known.

However, when you fly IFR/VFR on top, you must adhere to both the IFR and VFR flight rules. Flight must be conducted in VFR weather conditions; the altitude must be appropriate to the direction of flight and at least 1,000 feet above any cloud, smoke, haze or fog layer; and you are responsible for avoiding other aircraft, although ATC may advise of other known traffic. In addition you must follow applicable IFR flight rules, such as maintaining minimum IFR altitude; position reporting; maintaining radio communications; notifying ATC of flight plan changes; and adhering to ATC clearances. (Note: VFR on top operations are not authorized for positive control areas.)

• IFR Approach Amendments

The NOS instrument approach plates have amendment numbers. Sometimes these numbers are changed when a plate is updated and sometimes they are not. Can you explain the meaning of the amendment number?

Dennis Pinion
Canoga Park, Calif.

Amendment numbers are changed only when there is a change in the procedure itself. If the chart is revised for other reasons, such as a change in frequency, lighting, or airport data, the amendment number remains the same.

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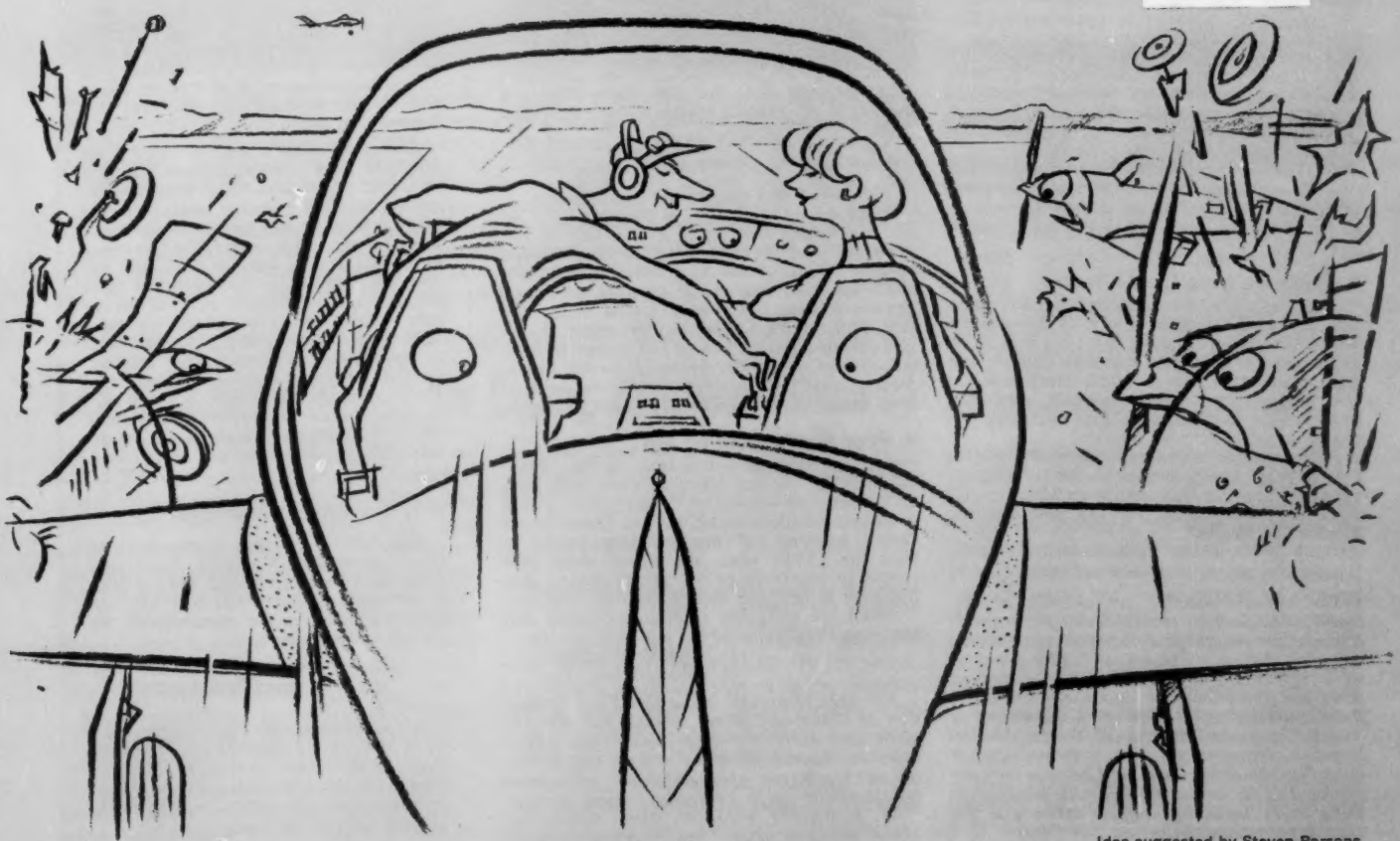

Cause chain reactions

Idea suggested by Steven Parsons, ATC, Norwood, Mass.